

Ambient Air Quality Impact Report (AAQIR)

Elk Hills Power (SJ 99-02)

This document serves as the statement of basis as required by 40 CFR 124. It sets forth the legal and factual basis for the permit conditions, including references to applicable statutory or regulatory provisions, including provisions under 40 CFR 52.21.

1.0 APPLICANT

Elk Hills Power
P.O. Box 1001
Tupman, CA 93276

2.0 PROJECT LOCATION

This combined cycle power plant is located on 12 fenced acres of land in Kern County approximately 25 miles west of Bakersfield, California.

With respect to the National Ambient Air Quality Standards (NAAQS), this location is designated as attainment/unclassified for nitrogen dioxide (NO₂, a component of NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), and lead, and is designated as nonattainment for ozone and particulate matter. The U.S. Environmental Protection Agency Region IX has jurisdiction for regulating all attainment/unclassified pollutants in this area.

3.0 FACILITY DESCRIPTION

The Elk Hills Power (EHP) Plant is a 500 MW natural gas-fired combined cycle facility. The plant includes two combustion turbine-generators (CTG) and two heat recovery steam generators (HRSG) equipped with duct burners. The Permittee uses selective catalytic reduction (SCR) with ammonia injection for NO_x emissions control, and an oxidizing catalyst for CO emissions control.

4.0 INITIAL PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PERMIT

The Elk Hills Power Plant is subject to the requirements of the Prevention of Significant Deterioration (PSD) regulations for NO₂ and CO. EPA issued a PSD permit (SJ-99-02) to EHP in February 2001 for the construction and operation of this facility. The facility started commissioning in early 2003 and completed its required performance testing in June 2003; it has been operating since that time. Prior to the current revision, the permit was modified on March 4, 2004.

5.0 PROPOSED REVISIONS

EHP submitted an application to EPA to revise its current PSD permit on November 2, 2004. EHP has since modified its request to include the following revisions to the permit:

1. Increase the duration of extended startups from 4 to 6 hours; and
2. Revise the NO_x emission limit for extended startups from 400 lbs/event to 800 lbs/event.

This permit revision addresses previously established limits that have been found to be technically infeasible following initial startup and operation of the facility. The requested revisions do not involve a physical change to the facility or a change in the method of the facility's operation. Furthermore, the facility is not proposing to increase its annual potential to emit as a result of these revisions.

When processing the previous permit modification, definitions pertaining to startup and shutdown operations were inadvertently deleted; while making the revisions described above, EPA is taking the opportunity to correct this error and make other administrative changes.

6.0 PREVENTION OF SIGNIFICANT DETERIORATION REVIEW

In evaluating applications to revise PSD permits, EPA considers whether the change triggers new requirements and whether the requested changes to the permit ensure that the PSD requirements continue to be met. EPA must also ensure that the revisions do not interfere with the source's obligation or ability to protect ambient air quality and increments, or to comply with the requirements of BACT and the Endangered Species Act.

6.1 Emissions Increase

This permit revision will result in increases of short term emissions of NO₂ only. No changes are being made to the annual emission limits for NO₂ or CO. Because the proposed changes to the permit will not result in a significant emissions increase as defined in 40 CFR §§ 52.21(b)(3) and (23), they do not trigger new PSD requirements.

6.2 Air Quality Impacts

The PSD regulations require an ambient air quality impact analysis to determine the impacts of the proposed project on ambient air quality. For all regulated pollutants emitted in significant quantities, the analysis must consider whether the proposed project will cause a violation of (1) the applicable PSD increments, and (2) the National Ambient Air Quality Standards (NAAQS).

With respect to NO₂, EHP conducted modeling when it applied to the San Joaquin Valley Air Pollution Control District (SJVAPCD) for a similar permit revision. EHP's proposal for an 800 lb/event limit over a six hour period represents average emissions of 133 lbs/hr for both turbines. In the modeling conducted for the SJVAPCD permit modification, the startup limit of 400 lb/hr for both turbines was found by the District not to cause a significant impact to air quality, including with respect to the one hour California Ambient Air Quality Standard for NO₂. Modeling with ISCST3 was conducted using meteorological data collected at the McKittrick Westside Operators station from 1993 to 1995. Worst case stack parameters and emission rates for all sources at the EHP facility were used. The results of the short term analysis are shown below.

Table 1: Maximum NO₂ Short-term Modeled Impact During Startup

Averaging Period	Turbine Emission Rate (lbs/hr/unit)	Maximum Impact (µg/m ³)	Background Concentration (µg/m ³)	Total Impact (µg/m ³)	CAAQS (µg/m ³)
1-hour	200	320	97	417	450

Because the NAAQS for NO₂ is based on an annual averaging period and no changes to the annual emission limit are proposed at this time, and because the CAAQS for NO₂ is significantly more stringent than the NAAQS, this permit revision will not cause or contribute to an exceedance of the national standard.

Modeling results from the previous PSD application (April 2003) are shown in Table 2.

Table 2: Significant Impact Level and Class II PSD Increment Results for NO₂

Averaging Period	Facility Emissions (tpy)	Maximum Modeled Impact (µg/m ³)	Significant Impact Level (µg/m ³)	Class II Increment (µg/m ³)
Annual	171.5	0.25	1	25

The forgoing analysis demonstrates that all NO₂ impacts will be below the applicable thresholds and that the proposed changes will not cause or contribute to an exceedance of any ambient air quality standard or PSD increment.

6.3 Best Available Control Technology (BACT)

6.3.1 Definition of Best Available Control Technology

Any major source or major modification subject to PSD requires an analysis to ensure the application of best available control technology (BACT) [40 CFR §52.21(j)]. The federal Clean Air Act (CAA) defines BACT as follows:

The term "best available control technology" means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under the Clean Air Act emitted from or which results from any major emitting facility. The permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, makes a BACT determination through application of processes and available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of BACT result in emissions of any pollutant which will exceed the emission allowed by any applicable standard established pursuant to section 111 (NSPS) or 112 (NESHAP) of the Clean Air Act [CAA §169(3)].

EPA has also stated that BACT may be a design, equipment, work practice, or operational standard, or combination thereof in the event the Agency determines that emission measurement limitations for a particular unit would make the imposition of an emission standard infeasible. *See* EPA's New Source Review Manual, at page B-56.

EPA conducted a top-down BACT analysis for operations at EHP when the initial PSD permit was issued in 1999. This analysis can be found in the support document for that permit. EPA is proposing to modify the current PSD permit to address startup emissions at the plant.

6.3.2 BACT for Combustion Turbines – Startup Operations

BACT applies during all modes of operation. However, alternate BACT limits may be specified for various modes of operation. The current PSD permit, as amended by EPA in March, 2004, specifies a BACT limit of 2.5 ppmv for NO₂ emissions during steady state operations. It also contains alternate BACT limits for startup and shutdown periods when compliance with the steady state limit is not technically feasible.

Description of Startup Process

Bringing a power block online in a combined-cycle system is a complicated process. EHP consists of two combustion turbines (CTs), two HRSGs, and one steam turbine. The two CTs share a common starting system and only one CT can be started at a time. The startup sequence includes multiple steps in which the equipment power output is "ramped up" until it reaches normal operating conditions (defined as Mode 6). This consists of carefully increasing the CT's speed and load as the HRSGs, steam drums, steam piping, emissions control equipment, steam turbine, and other equipment are heated and brought to a stable operating condition. Operating the systems within these vendor specified

boundaries is required to protect personnel and equipment, and maintain equipment warranties.

During a typical startup at EHP, one CT is started and ramped up to low load where it is held until the exhaust gases bring the respective HRSG and steam systems to a specified temperature range. The HRSG is limited to a maximum heat increase rate of 15 degrees F per minute. The second CT is allowed to start following synchronization of the first CT and is also held at low load for warm up of its HRSG and steam systems. Both CTs are required to supply an adequate amount of steam for the steam turbine and its auxiliary equipment. One CT is dedicated to run in temperature matching mode for steam turbine warm-up. As soon as the HRSG achieves the proper temperature, the steam turbine is started and gradually heated as steam becomes available to drive the system. Increases in steam turbine speed are constrained by the temperature differential between the metal surfaces and the steam. This differential must not exceed 300 degrees F. During this operation, the steam turbine vibration levels must be closely monitored. A problem can occur due to uneven expansion between the steam turbine rotor and casing. This uneven expansion can cause high vibrations and will limit increases in the steam turbine speed. This delay in raising steam turbine speed requires that the CTs be held at low load until the vibration levels are within specification. The other CT is utilized for auxiliary purposes, primarily for the air ejectors, which establish and maintain steam turbine condenser vacuum.

The HRSGs have three separate pressure sections, each with temperature increase rate limitations. Both CTs must be held at low load until the HRSGs can provide sufficient heat for operating the associated fuel gas heaters required for the dry low-NO_x combustion system. The CT load cannot be raised again until the fuel gas reaches the vendor specified set point. Loads are increased gradually until normal operating loads and conditions are reached.

Emissions Control During Startup

During the startup process, the oxidation catalyst (for CO/VOC control) increases in effectiveness as the exhaust gas temperature increases. The Selective Catalytic Reduction (SCR) system for NO_x control does not become effective until the exhaust gas temperature reaches 500° F and ammonia injection begins. EHP has optimized the SCR effectiveness and minimized emissions during startup by lowering the ammonia injection temperature within the vendor specifications. To ensure emissions are reduced by the SCR as much as possible during startup, a condition has been added to the permit requiring that ammonia injection begin as soon as the exhaust gas temperature reaches 500° F. The early introduction of ammonia reduces NO_x emissions through the remainder of the startup process but cannot achieve compliance with the 2.5 ppmvd @ 15% O₂ NO_x permit limit until the CT begins operating in dry low-NO_x mode.

Proposed Limits

While the current PSD permit contains alternative limits for startup and shutdown events, EHP has found that it can not meet the four hour limitation for extended startups when following all of the vendor specifications for startup procedures. EHP has accordingly proposed to extend the allowable time to six hours. An increase in the NO₂ emission limit is also necessary because the current limit is expressed on an event basis. EHP's proposal for 6 hours and 800 lbs/event for both turbines is supported by actual CEMs data supplied by another facility for similar equipment.

6.4 Endangered Species Act

Pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1531, and its implementing regulations at 50 CFR Part 402), EPA is required to ensure that any action authorized, funded, or carried out by the Agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat for such species.

During the review of the initial application for this facility, EPA requested that the Bureau of Land Management (BLM) act as the lead agency in the Section 7 consultation process. Action was required by BLM to authorize the project because a half-mile section of the new raw water supply pipeline for the plant crossed BLM land. BLM submitted a request for a formal consultation with the FWS on December 10, 1999. On January 17, 2001, FWS issued a BO (1-1-00-F-0022) that discusses impacts to the following federally listed animal and plant species: San Joaquin kit fox, giant kangaroo rat, tipton kangaroo rat, California condor, blunt-nosed leopard lizard, and Hoover's eriastrum. FWS concluded in the BO that the effects of the project were not likely to jeopardize the continued existence of any of the listed species and not likely to destroy or adversely modify designated critical habitat.

Subsequent to the issuance of the original BO, one new species occurring within the quad containing the EHP project has been listed. Specifically, the Buena Vista Lake shrew (*Sorex ornatus relictus*) was listed as endangered on March 6, 2002. Although critical habitat for this species is designated in Kern County, the FWS previously determined that the majority of the impacts on the species listed in the 2001 BO were from construction-related activities (e.g., habitat loss, excavation of dens, etc...); emissions of air pollutants were not mentioned as a source of any impacts. Based on this evaluation, EPA has concluded that the small changes in short-term air emissions associated with this permit revision will not affect listed species explicitly covered by the BO or to the newly listed shrew.

7.0 CONCLUSION AND PROPOSED ACTION

Based on the information supplied by Elk Hills Power, LLC, EPA has determined that the proposed revisions to the PSD permit do not trigger new major modification requirements under the PSD rules, and that the permit revisions regarding turbine startup activities continue to satisfy PSD requirements for BACT and protection of ambient air quality and increment consumption. Therefore, EPA is proposing to issue a revised PSD permit.